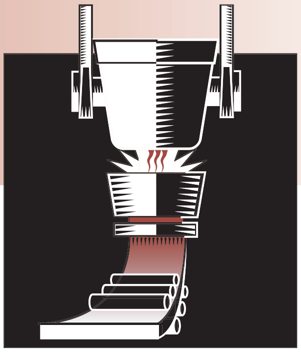
STEEL

Project Fact Sheet



Hot Strip Mill Transfer Bar Rapidfire™ Edge Heat Project

Innovative edge heater produces higher quality steel with fewer defects while reducing energy consumption and greenhouse gas emissions

Benefits

Based on a plant producing 3 million tons of steel coil per year:

- Energy savings of 28% (gas consumed will drop from 83 million to 60 million cubic feet)
- CO_2 emissions cut by 1310 tons
- NO_x cut by 6 tons
- Capital and installation costs more than 90% lower than reheat furnaces
- Strength and ductility of the final product increased compared to conventional heating processes

Applications

For hot strip mill transfer bar heating in the production of steel and coils.

Project Partners

NICE³ Program
Washington, DC

Gas Research Institute
Chicago, IL

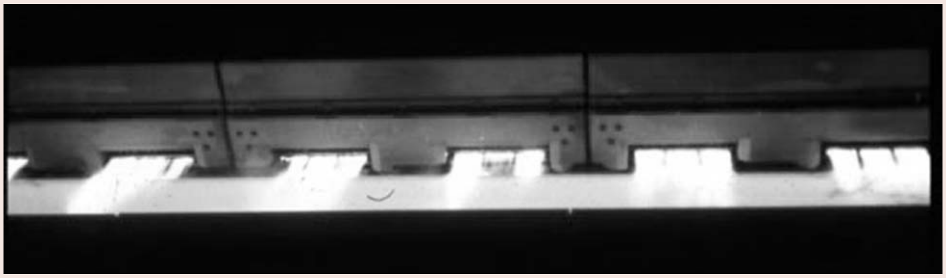
Weirton Steel Corporation
Weirton, WV

West Virginia Energy Effiency Program
Charleston, WV

Weirton Steel, with financial assistance from the Department of Energy's NICE³ Program, is demonstrating an effective edge heater that reheats the transfer bar edges of steel slabs during processing. The Rapidfire Edge Heater, developed by Air Products and Chemicals, Inc. (APCI), for the Gas Research Institute (GRI), addresses the problem of edge-related defects that occur during the production of sheet steel coils. During the gauge reduction process, the Rapidfire Edge Heater effectively maintains a hot-working temperature, the primary processing factor affecting grain size of steel and the resultant key mechanical characteristics of the end product: strength, hardness, and ductility.

In a typical hot strip mill, steel slabs are overheated to ensure that edges remain hot enough for final processing. Once a slab has "dropped out" of a reheat furnace and into the open air, the temperature bar drops by 700°F. This drastic temperature loss results in uneven cooling that causes cracks and creates shape and metallurgical variations on the slab, particularly on surface edges. When overheating is inadequate, the product exhibits poor mechanical properties at the edges and will usually be rejected for having too low a finishing temperature. Devices, such as heat retention covers, do not effectively maintain even slab temperatures. Using induction heaters is another approach to keep slab temperatures constant, but these heaters are five times more expensive to operate than the Rapidfire system.

Rapidfire™ Edge Heater



The Rapidfire Edge Heater ensures evenly heated steel slabs to produce a higher quality product at less cost.

To ensure more evenly heated slabs, the Rapidfire Edge Heater employs a GRI-patented process that incorporates APCI oxygen-natural gas burners to generate higher-temperature flames. The approach transfer bar is guided so that heat is efficiently transferred into the bar's working edges. This reduces the need to overheat slabs and produces fewer edge-related defects. This unique system uses 28% less energy than current methods. In addition, it lowers capital costs and eliminates pollutants because burning pure oxygen (rather than regular air) with natural gas reduces CO_2 and NO_x emissions.

Project Description

Goal: Demonstrate that the Rapidfire Edge Heater produces higher quality steel with fewer edge-related flaws.

The edge heater employs oxygen-natural gas burners (rather than air-fired) to produce higher-temperature flames directly onto transfer bar edges. As the bar approaches the finishing mill, a straddle guiding bar centers it and ensures that its edges receive the brunt of heat from the oxygen-gas burners. Nearly 2000°F hotter than a conventional air-natural gas flame, the Rapidfire flame impinges directly on the metal being heated. The burner contains many individual oxygen and natural gas ports to improve mixing of gases and provide a uniform flame pattern. Burner ports are configured longitudinally, allowing the flame to match the transfer bar's edge as it passes through the centering guides. Through more direct and uniform flame distribution onto the metal, this system provides much higher heat transfer rates. Other technologies, such as reheat furnaces that are far more energy intensive and require great amounts of preheated combustion air, do not prevent uneven transfer bar cooling, a problem that the Rapidfire system eliminates.

Weirton Steel is demonstrating this new technology with assistance from the Gas Research Institute, the West Virginia Energy Efficiency Program, and the NICE^3 Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Preliminary design of the centering guide system and other components were completed in December 1999.
- Equipment purchasing began in January 2000 with delivery and installation of major equipment completed in December 2000. Pre-testing and repair of existing oxygen/natural gas equipment was also completed in December 2000.
- Installation of the centering guide cooling equipment, oxygen/natural gas burners and utilities was completed in June 2001.
- Firing of the burners and initial testing of the thermal capacity of the centering guides took place through September 2001.
- Testing and demonstration of the edge heating benefits to start in October 2001 with completion by December 2001.

NICE^3 – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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